

FORM PTO-1390 (Modified)
(REV 11-98)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

000437

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/719881

INTERNATIONAL APPLICATION NO.
PCT/DE99/01806INTERNATIONAL FILING DATE
15 June 1999PRIORITY DATE CLAIMED
16 June 1998

TITLE OF INVENTION

Marking Substances and Security Elements for Testing Documents, Securities, Bank Notes, Wrappings and Products

APPLICANT(S) FOR DO/EO/US
PUTTKAMMER et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☒ Other items or information:

a Post Card Receipt

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR		INTERNATIONAL APPLICATION NO. PCT/DE99/01806		ATTORNEY'S DOCKET NUMBER 000437	
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21. The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **\$1,000.00**

☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **\$860.00**

☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **\$710.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **\$690.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **\$100.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)). **\$0.00**

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	TOTAL	
Total claims	27 - 20 =	7	x \$18.00	\$126.00	
Independent claims	1 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$986.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). <input checked="" type="checkbox"/>				\$493.00	
SUBTOTAL =				\$493.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$493.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$493.00	
				Amount to be:	
				refunded	\$
				charged	\$

CALCULATIONS PTO USE ONLY

☒ A check in the amount of **\$860.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.

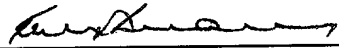
☐ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. _____ A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Law Offices of Karl Hormann
86 Sparks Street
Cambridge MA 02138-2216

Tel.: (617)-491-8867



SIGNATURE

Karl Hormann

NAME

26,470

REGISTRATION NUMBER

18 December 2000

DATE

P10/REV01

**VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY
STATUS (37 CFR 1.9(f) AND 1.27 (c)) - SMALL BUSINESS CONCERN**

Docket No.
000437

Serial No.
09/719,881

Filing Date
18 December 2000

Patent No.

Issue Date

Applicant/ Patentee: PUTTKAMMER, Frank; PUTTKAMMER, Monika and ZSCHERPE, Gunther

Invention: **Marking Substances and Security Markings and Method of their Integration in Paper Pulp Lines and Method of Testing**

I hereby declare that I am:

- ☐ the owner of the small business concern identified below:
☒ an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN: WHD elektronische Prueftechnik GmbH.

ADDRESS OF CONCERN: Industriestrasse 19, D-01129 Dresden, Germany

I hereby declare that the above-identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under Section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the above identified invention described in:

- ☒ the specification filed herewith with title as listed above.
☐ the application identified above.
☐ the patent identified above.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed on the next page and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ no such person, concern or organization exists.
☐ each such person, concern or organization is listed below.

FULL NAME _____
 ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
 ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
 ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

FULL NAME _____
 ADDRESS _____

☐ Individual ☐ Small Business Concern ☐ Nonprofit Organization

Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING: GERT FLEEGE, MANAGER

TITLE OF PERSON SIGNING _____

OTHER THAN OWNER: _____

ADDRESS OF PERSON SIGNING: _____


elektronische Prüftechnik GmbH
 Industriestraße 19 • D - 01129 Dresden
 Tel. (03 51) 8 49 15 56 • Fax (03 51) 3 49 15 96

SIGNATURE: x

DATE: 18.12.2000
 18 December 2000

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

International Application No.: PCT/DE99/01806

International Filing Date: 15 June 1999

Inventor: Puttkammer et al.

For: Marking Substances and Security Elements for Testing

Documents, Securities, Bank Notes, Wrappings and Products

86 Sparks Street
Cambridge MA 02138-2216
18 December 2000

Hon.
Assistant Commissioner for Patents
Washington DC 20231

Box PCT

Preliminary Amendment Prior to Claims Fee Calculation

Sir:

With a view to putting the English translation of their instant International Application into a condition believed to satisfy U.S. patent prosecution standards in formal respects and to avoiding excess claims fees otherwise due, Applicants courteously request of the following preliminary amendment into the said English translation.

Please note that this request is based on the specification and claims as appended to the International Preliminary Examination Report dated 26 September 2000.

In the Specification:

Page 1, line 3: insert --BACKGROUND OF THE INVENTION.

1. Field of the Invention.--;

line 13: insert --2. The Prior Art.--;

page 4, line 3: insert --OBJECTS OF THE INVENTION.--;

line 18: insert --BRIEF SUMMARY OF THE INVENTION.--;

page 5, line 6: insert --DESCRIPTION OF THE SEVERAL DRAWINGS.--;
page 6, line 19: insert --DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS.--;
page 15, line 2: delete "Patent Claims" and substitute --What is claimed is-- therefor;
page 29, line 2 (of the translation of the originally filed application): enter --ABSTRACT OF THE DISCLOSURE.--.

In the claims:

Claim 3, line 1: change "claims 1 and 2" to --claim 1--;
claim 4, line 1: change "claims 1 and 2" to --claim 1--;
claim 5, line 1: change "claims 1 to 4" to --claim 1--;
claim 6, line 1 and 2: change "one or more of claims 1 to 5" to --claim 5--;
claim 11, line 1 and 2: change "one or more of the preceding claims" to --claim 1--;
claim 12, line 1 and 2: change "one or more of the preceding claims" to --claim 1--;
claim 13, line 1 and 2: change "one or more of the preceding claims" to --claim 12--;
claim 14, line 1 and 2: change "one or more of the preceding claims" to --claim 13--;
claim 15, line 1 and 2: change "one or more of the preceding claims" to --claim 14--;
claim 16, line 1 and 2: change "one or more of the preceding claims" to --claim 15--;
claim 17, line 1 and 2: change "one or more of the preceding claims" to --claim 16--;
claim 18, line 1 and 2: change "one or more of the preceding claims" to --claim 17--;
claim 19, line 1 and 2: change "one or more of the preceding claims" to --claim 18--;
claim 20, line 1 and 2: change "one or more of the preceding claims" to --claim 19--;
claim 21, line 1 and 2: change "one or more of the preceding claims" to --claim 20--;
claim 22, line 1 and 2: cancel "or one or more of claims 20 and 21";
claim 22, line 1 and 2: cancel "or one or more of claims 20 and 22";
claim 23, line 1 and 2: cancel "or one or more of claims 20 and 22";
claim 24, line 1 and 2: cancel "or one or more of claims 20 and 22";
claim 25, line 1 and 2: change "one or more of the preceding claims" to --claim 1--;
claim 26, line 1 and 2: change "one or more of the preceding claims" to --claim 1--;

claim 27, line 1 and 2: change "one or more of the preceding claims" to --claim 1--.
claim 28, line 1 and 2: change "one or more of the preceding claims" to --claim 1--
and
claim 29, line 1 and 2: change "one or more of the preceding claims" to --claim 1--

Respectfully submitted,

Karl Hormann
Registration No.: 26,470

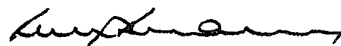
Area Code (617)-491-8867

09749884-014001

and

claim 27, line 1 and 2: change "one or more of the preceding claims" to --claim 1--.

Respectfully submitted,



Karl Hormann

Registration No.: 26,470

Area Code (617)-491-8867

09749881-011001



11/PRTS



JCOY Rec'd PCT/PTO 18 DEC 2000

09/719881

**Marking Substances and Security Markings for Testing
Documents, Securities, Bank Notes, Wrappings and Products**

The invention relates to marking substances for security markings in
5 documents, securities, bank notes, wrappings and products in accordance
with the preambles of claim 1.

To raise the level of certainty against counterfeiting, paper pulp lines of
documents, securities, bank notes, wrappings and of products are provided
10 with marking substances. Light-activated marking substances hitherto used
are at present available in the market, so that counter fitters are in a position
to falsify security elements fabricated with them.

In EP 753 623 there is described, in this connection, a security sheet
15 with an electrically conductive element. The security sheets consists of a
carrier matrix having a fiber structure and the conductive element is a security
thread constituted by a foil. The foil is coated with an electrically conductive
polymer from the group of polythiophenes. The electrically conductive
polymer is applied to the foil in liquid or dispersed form.

20

In U.S. 5,112,672 there is described a security document having an
imbedded electrically conductive security thread. The security thread is
provided with a metal coating which is provided with an electrically conductive
polymer for bridging interruptions.

25

In U.S. 5,419,424 there is disclosed a testing device for the security
thread in bank notes. The testing device is provided with sensor electrodes
which detect the security thread by capacitive coupling.

30

In DE 43 34 797 there are disclosed a method of fabricating
counterfeit-proof documents as well as a method of the testing thereof. The

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documents contain a grid work of metal wires which are contacted at their junctions.

In EP 839 950 there is disclosed a method for inserting substances in
5 a running fibrous web. The substances are introduced into the fibre
suspension at or prior to the site where the web enters the machine. The
introduction takes place at several sites distributed over the width of the fiber
web and at least at one site, it is performed intermittently.

10 With a view to setting up hurdles against this situation for counter
fitters complicated solutions have been devised using light-activated marking
substances in which, as described in German patent specification DE 196 53
423, light absorbing substances invisible to humans are additionally used. In
this manner printed images with noticeable error sections are generated
15 during testing using infra-red light.

Furthermore, to improve the certainty against counterfeiting, marking substances are applied in a predetermined distribution to a web of paper to render their authenticity machine-readable. In accordance with DE 197 14 519 substances not visible by humans are used for this purpose, which are superimposed as a linearly designed markings on a visible printed image. Because of its physical property the marking substance is supposedly detectable by a machine. Electrical conductivity is mentioned, among others, as one of the physical properties; however, there is no teaching of any marking substance which is invisible to the human eye.

A security element currently commonly used in bank notes is embodied in a foil structure consisting at least of a support foil and a metallization applied to the support foil. A so-called security thread is embedded, either completely or with windows (interruptions), into the paper web. Originally, such a safety thread including recognizable demetallized

sections shaped as symbols or letters served only for visual testing by humans. In attempting to improve the certainty against counterfeiting it was considered additionally to test the electrical conductivity of the metallization. Until now, the realization of such attempts has on the one hand been

5 frustrated not only by the high mechanical use suffered by bank notes, for instance, by creasing and folding by a user, but also by bending in automatic teller machines and counting machines. On the other hand, the foil structure is already subjected to considerable stress, because of tension and bending, during the technological process of manufacturing the paper. As a result,

10 there will occur in the metallization randomly distributed fine hairline fractures which render any test result uncertain and not reproducible. However, to act against counterfeiting of these security elements, it is not only necessary to prove the presence of a metallization in bank notes, but authenticity must be recognized on the basis of measuring a certain conductivity value. In

15 principle, this problem is not solved by using metallicly acting printing inks instead of vapor deposited metallizations, as proposed by DE 43 44 553 and EP 0 659 587.

Since electrical conductivity is one of the essential properties of

20 metals, it seems to be obvious that counter fitters will assume the electrical conductivity of a metallization. In fact, technological equipment is currently readily available for inserting actual metallizations including their image-like designs as counterfeits of a security element into documents, securities, bank notes, wrappings or products. However, since electrical conductivity is a

25 testing parameter which can be detected quickly and with certainty, no desire exists at present to do away with this security element. It is an additional disadvantage that the properties of the metallization which is visible to the human eye are substantially constant as for the majority of users it is to serve as a constant security element always recognizable as such. Finally, a

30 relatively large number of persons are familiar, in connection with its fabrication and testing, with the secrets of this humanly recognizable security

element, so that the size and unsurvailability of this group of persons introduces a further risk potential.

It is, therefore, an object of the invention to propose an electrically
5 conductive marking substances and methods of their integration into the
paper pulp line of documents, securities, bank notes, wrappings and products
in which the disadvantages mentioned above do not occur. It is a further
object of the invention to propose marking substances of the kind which
contribute to improving the certainty against counterfeiting because the
10 necessity has arisen for providing a further easily variable security element
which draws less attention to itself than does the visually recognizable
metallization, or to propose a security element at different positions where it is
not expected and where it can be detected only by testing technology
operating with extreme precision. These characteristics and elements serving
15 security are integrated into the paper pulp line either directly or in connection
with other security elements included in the paper pulp line, such as safety
threads.

In accordance with the invention, the object is accomplished by the
20 characteristics and elements of claim 1 as well as their specific embodiments
defined in the sub-claims. Aside from the claims, the characteristics of the
invention are also apparent from the description and the drawings, the
characteristics constituting protectable embodiments either by themselves or
in several sub-combinations, for which protection is sought.

25

The solution in accordance with the invention provides the advantage,
that the polyethylene dioxythiophene polystyrene sulfonate (PEDT/PSS) in
connection with safety paper, of furnishing marking substances and safety
elements with hidden detectable elements which cannot be recognized by
30 human vision and the homogeneous or partial presence of which is to be
tested. Surprisingly, at the same time, the advantage results of a

continuously operating, time-saving and cost-efficient method of introducing marking substances and safety elements into paper pulp lines and by the excellent physical properties of the polyethylene dioxythiophene polystyrene sulfonate (PECT/PSS), the good compatibility during connection with the

5 paper pulp suspension.

The invention will be described on the basis of the following examples and of the figures.

- 10 Fig. 1 is a schematic side elevational view and top elevational view of a long strainer of a paper making machine for depicting the method of the partial integration of the marking substance in a linear configuration;
- 15 Fig. 2 is a schematic side elevational view and top elevational view of a round strainer of a paper making machine for depicting the same method;
- 20 Fig. 7 is a graph of a signal generated when sweeping a sensor over a bank note with a homogeneous distribution of marking substance and a water mark;
- Fig. 7a depicts the combining of sensor signals;
- 25 Fig. 8 is a schematic side elevational view of a water mark embossing roller with a marking substance transfer roller;
- Fig. 8a is a graph of a signal of an electrically conductive water mark in conventional paper;
- 30 Fig. 9 is a schematic presentation during partial application of marking



substance onto or integration of marking substance into the paper pulp line;

5 Fig. 10 depicts graphs of signals of the detection of partial marking substance;

Fig. 11 depicts a foil structure with a support foil, a metallization and a further layer of an electrically conductive polymer;

10 Fig. 12 depicts another foil structure with a support foil, a metallization and a further layer of an electrically conductive polymer;

Fig. 13 depicts a foil structure made of two support foils and a metallization, each support foil supporting a further layer of an electrically conductive polymer;

15

Fig. 14 depicts a foil structure made of two support foils, a metallization and a further layer of an electrically conductive polymer.

20 In Fig. 1, there is depicted a paper making machine in schematic side and top elevational views, with a long strainer 1, a pulp applicator 3, output tubes 17, a control unit 18 for the output tubes 17, an automatic valve 19 in each output tube 17, a pump 20 for the circulation of the marking substance and a supply vessel 26 for the marking substance for partial integration.

25 Furthermore, test zones 14 containing marking substance are shown.

 Fig. 2 depicts a round strainer 2 of a paper making machine in schematic side and top elevational views with a pulp input 4, partial test zones 14, output tube 17, control unit 18 for the output tubes 17, automatic

30 valve 19 in each output tube 17, the pump 20 for the circulation of the marking substance and the supply vessel 26 for the marking substance for

partial integration.

Fig. 7 depicts the signal graph as a diagram of voltage U as a function of the number of channels when sweeping the optical scanner sensors 10 and the capacitive scanning sensors 11 over a bank note with homogeneously distributed marking substance 6 and with an electrically conductive embossed section 24. The sensor channels 1 - 14 are depicted schematically.

Fig. 7a depicts the signal combining of the optical scanning sensors 10, of the capacitive scanning sensors 11 and of the optical sensors 13 for actuating the capacitive scanning sensors 11 during testing of a sheet provided with partial test zones 14.

Fig. 8 is a schematic side elevational view of a water mark embossing roller 5 having embossing segments 25 and with a marking substance transfer roller 7, an electrically conductive test zone 9 structured as a water mark, a supply vessel 16 for marking substance and a pressure roller 27.

Fig. 8a depicts the signal graph as a diagram of voltage U as a function of the number of channels during testing of an electrically conductive test zone 9 in paper not provided with marking substance.

Fig. 9 is a schematic presentation of testing with the capacitive scanning sensors 11 following partial integration of marking substance into the paper pulp line according to Fig. 8, the optical sensors 13 for activating the capacitive sensors and with different partial test zones 14a, 14b, 14c.

Fig. 10 depicts signal graphs 23 of the partial marking substance detection according to the arrangements in Fig. 9.

Fig. 11 depicts a foil structure consisting of a support foil 28, a metallization 29 and a further layer 30 of an electrically conductive polymer.

Fig. 12 depicts another foil structure consisting of a support foil 28, a metallization 29 and a further layer 30 of an electrically conductive polymer.

Fig. 13 depicts a foil structure consisting of two support foils 28; 28' and a metallization 29, each support foil 28, 28' carrying a further layer of an electrically conductive polymer.

Fig. 14 depicts a foil structure consisting of two support foils 28, 28', a metallization 29 and a further layer 30 of an electrically conductive polymer.

Example 1:

Figs. 1 and 2 depict the manner in which a partial application of the found polyethylene dioxythiophene polystyrene sulfonate (PEDT/PSS) is being accomplished by metering devices positioned precisely over the paper pulp line 6. The precondition for a homogeneous supply of the metering devices with marking substance is a continuous circulation of the paper pulp by pumps 20 in the entire tubular system including the supply vessel 26 of the marking substance to be partially integrated. The marking substance is partially applied to, or integrated into, the paper pulp line by an array of metering devices each consisting of an output tube 17 with an automatic valve 19. This leads to the formation, in dependence of the control, linear continuous test zones 14a, discontinuous test zones 14b or dotted test zones 14c. See also Fig. 9. By cutting the paper pulp line into sheets partial test zones 14 with marking substance result. These may extend over the entire width or length of the sheet, or they may be present as sections over the length or width of the sheet. The width of the lines or line sections must be adjusted to the resolution of the scanning sensors 10; 11. Preferably, the

width of the line is chosen to be 2 mm.

The use of electrically conductive polymers results in the advantage that these polymers are compatible with the other contents of the paper pulp.

- 5 The integration into the paper pulp is thus substantially less complicated than it is in the case of solid marking substances since electrically conductive polymers are available in liquid state. The required concentrations make possible a substantially transparent electrically conductive marking.

10 Example 2:

As shown in Fig. 8, an printed image of the PEDT/PSS is produced on the paper web by means of the embossing roller 5 and the marking substance transfer roller 7. The printed image of the embossing segments 25

- 15 corresponds to the pictorial rendition of the electrically conductive test zone shown as a water mark 9.

Example 3:

- 20 Figs. 1 and 2 depict that the test zones 14 in the paper pulp line 6 are tested for the partial or homogeneous presence of marking substance. The test result derived therefrom affects, by way of the control unit 18, the automatic valves 19 in the output tubes 17.

- 25 As has already been mentioned, Figs. 7, 7a, 8a, 9 and 10 depict the testing in different applications, with corresponding signal graphs.

- On the basis of a water mark in the embossed area 24, Fig. 7 depicts the testing of electrical conductivity of the paper 6 as a reference test relative
30 to the test of the pictorial structure of the water mark.

The paper 6 with the water mark sequentially moves in the direction of the arrow through an array of optical scanning sensors 10 and a further array of capacitive scanning sensors 11. The associated signal graph depicts the matching voltage course of the optical scanning sensors 10 and of the capacitive scanning sensors 11, shown here as a function of the number of the channels.

Figs. 9 and 10 show the testing of marking substance linearly deposited on paper 6 as well as the signal graphs 23 generated thereby.

In Fig. 9a, paper 6 contains a test zone 14a consisting of marking substance applied in a continuous linear pattern. When passing through the test zone consisting of the optical sensors 13 and the capacitive scanning sensors 11 a corresponding continuous voltage curve $U = f(t)$ is generated in the signal graph 23.

In Fig. 9b the marking substance is applied in a pattern interrupted in regular intervals. During testing, a signal graph 23 is generated with corresponding regular breaks in the voltage curve $U = f(t)$.

In Fig. 9c the application in the test zone 14c is interrupted at irregular intervals. This, too, is reflected in the resulting signal graph 23.

Example 4:

The use of the electrically conductive marking substance in a foil structure to be included in a paper pulp line will hereinafter be explained with reference to Figs. 11 to 14.

The foil structure of the safety element to be included in a paper pulp line contains a support foil 28 made, for instance, of polypropylene, of a thickness of preferably 40 μm . The metallization 29 applied to the support foil

28, for instance, by vapor deposition or sputtering, is of an additional thickness of about 2 nm.

The metallization 29 is provided with demetallized sections shaped, for instance, as letters or numbers, which can be recognized in transmitted light by human vision. The demetallization extends in sections up to the edge of the support foil 28. At its obverse side the support foil 28 is provided with a further layer 30 made of the PEDT/PSS, in particular PEDT/PSS (polyethylene dioxythiophene polystyrene sulfonate) in accordance with formula CPP105 at a thickness of 1 μm to 2 μm . The addition of the further layer 30 results in a negligible increase in thickness. The foil structure including the marking substance in accordance with the invention included as a security element into the paper pulp line does not, therefore, in any way adversely affect by its insignificantly changed thickness documents or bank notes made from the paper pulp line, even in a stack of considerable height. Neither will the paper be weakened because of its increased thickness at the position where the safety element is embedded.

The metallization 29 applied to the support foil 28 by vapor deposition or sputtering, for instance, has a thickness of a few atomic layers and is thus relatively brittle depending upon the surface structure of the support foil. Folding, bending or creasing leads to arbitrarily distributed hairline fractures which render impossible any intended measurement of the conductivity of predetermined sections of the metallization 29. The other layer 30, however, is flexible and elastic and, compared to the metallization 29, is of a much higher ductility or expandability with respect to the surface structure of the support foil 28. Even when a bank note, for instance, is bent, creased or folded there will result not interruption or discontinuation of the further layer 30. Hence, the testing devices installed, for instance, in automatic teller machines will now derive for predetermined sections of the security element a value of the conductivity from the metallization 29 provided in accordance

with the state of the art, including any possible hairline fractures and from the relatively high-ohmic layer 30 connected in parallel to the metallization 29.

Example 5:

5

A preferred embodiment of the foil structure including the marking substance for a security element in accordance with the invention, for instance, in a bank note, is depicted in Fig. 11. Fig. 11 depicts the support foil 28 on one side of which there has been applied the metallization 29. The
10 other side of the support foil 28 carries the further layer 30 made of the electrically conductive polymer.

The further layer 30 is applied to the carrier foil 28 by conventional technological processes., for instance, by calendering. This leads to a
15 compound or laminated foil, to which the metallization 29 is subsequently applied as by vapor deposition, for instance.

Of course, it would also be possible to apply the further layer 30 of electrically conductive polymer to the metallization 29 after its vapor
20 deposition on the support foil 28. In such a foil structure, the further layer 30 would bring about a certain protective action in respect of the metallization 29.

Example 6:

25 Fig. 12 depicts another preferred embodiment of the foil structure including the marking substance in accordance with the invention. The support foil 28 and the metallization 29 are shown. Between the support foil 28 and the metallization 29 the further layer 30 of PEDT/PSS is provided as a bonding agent between support foil 28 and metallization 29. The
30 arrangement of the further layer 30 as a bonding agent is not limited to improving the adhesion between the support foil 28 and metallization 29. The

further layer 30 may be applied between any other desired foils or layers for improving their bond. However, used as a bonding agent between the support foil 28 and the metallization 29 results in the advantage that on the substantially more elastic further layer 30 the relatively brittle metallization 29 is capable of withstanding substantially higher mechanical stresses than if vapor deposited directly on the support foil 28.

Example 7:

Fig. 13 depicts a foil structure for a security element including the marking substance in accordance with the invention using a support foil 28 to which the metallization 29 has been applied. The metallization 29 is covered by a further support foil 28'. This is done, for instance, for the protection of the metallization 29 if, with a window thread or strip partially embedded in the paper web, it is subjected to higher stress. Increased stresses during the technological process of paper production are a further reason for the use of a further support foil 28'. At least one of the support foils 28; 28' is provided with the further layer made from electrically conductive polymer.

Example 8:

In Fig. 13, both support foils 28; 28' are provided with a further layer 30, whereas in Fig. 14 there is shown an embodiment in which only one of the support foils 28 is provided with the further layer 30 of electrically conductive polymer.

The invention is not restricted that the marking substance in accordance with the invention is used as a further layer 30 in a foil structure. The marking substance in accordance with the invention may be included in the paper line as a security element in any form.

Example 9:

5 The certainty against counterfeiting is improved by providing, in addition to the electric conductivity, further characteristics and to combine them appropriately. Thus, for instance, in addition to the electric conductivity of the polymer there may be provided marking pigments which can be recognized by human vision as well as those which can be detected by appropriate testing devices, with special light sources and optical sensors. Moreover, the invention also extends to the combination of the electric
10 conductivity with such additives which possess magnetic characteristics. Of particular advantage, in the context of the invention, is a combination of the electric conductivity and optical and magnetic marking substances. As a preferred application mention is to be made of hiding the magnetic properties by adding marking substances visible to humans. In this manner, a potential
15 counterfeiter will be uncertain about the presence of a magnetically active substance, particularly in view of the fact that the quantities used are small and their magnetic action cannot be easily detected.

20 In addition to the mere presence of optically effective additives in the PEDT/PSS, the invention also extends to arranging the optically effective additives within the electrically conductive polymer in a manner resulting in optical encoding, as, for instance, a dye pattern which may be evaluated by testing devices. The same is applicable to the magnetically effective additives the arrangement in accordance with the invention of which leads to
25 magnetic encoding such as, for instance, a magnetic line code.

30

Patent Claims:

1. Electrically conductive marking substance constituted by an electrically
5 conductive polymer for integration in paper pulp lines (6) of documents,
securities and bank notes for security elements to be included in paper
webs of documents, securities, bank notes, wrappings and products or
for combining with a support material for the fabrication of security
elements, characterized by the fact that the marking substance is a
10 polyethylene dioxythiophene polystyrene sulfonyl (PEDT/PSS).
2. Electrically conductive marking substance of claim 1, characterized by
the fact that the PEDT/PSS is preferably applied according to formula
CPP105.
- 15 3. Electrically conductive marking substance of claims 1 and 2,
characterized by the fact that in use the electrically conductive polymer
is indistinguishable from its environment.
- 20 4. Electrically conductive marking substance of claims 1 and 2,
characterized by the fact that in use the electrically conductive polymer
is distinguishable from its environment.
5. Electrically conductive marking substance of claims 1 to 4,
25 characterized by the fact that the marking substance is an electrically
conductive polymer the specific surface resistance of which is set by
the manner of application, by the manner of integration and/or by the
composition and/or the specific formulation.
- 30 6. Electrically conductive marking substance according to one or more of
claims 1 to 5, characterized by the fact that the PEDT/PSS contains an

additive.

- 5 7. Electrically conductive marking substance of claim 6, characterized by the fact that the additive is a pigment perceptible by human vision, an optically active or activatable pigment or a pigment with magnetic properties.
- 10 8. Electrically conductive marking substance of claim 1, characterized by the fact that the PEDT/PSS is present in or on a water mark in the embossing area (24).
- 15 9. Electrically conductive marking substance of claim 1, characterized by the fact that the PEDT/PSS is partially or homogeneously present in the paper pulp line (6) and/or partially or homogeneously on the paper pulp line (6).
- 20 10. Electrically conductive marking substance of claim 1, characterized by the fact that the PEDT/PSS is connected to a foil of the security element to be included in the paper pulp line (6).
- 25 11. Electrically conductive marking substance according to one of more of the preceding claims, characterized by the fact the PEDT/PSS is at least partially applied, preferably as a printed image, to the security element to be included in the paper pulp line (6).
- 30 12. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that a foil structure serving as a security element comprising at least a support foil (28) and a metallization (29) applied to the support foil (28) with sectional demetallizations up to the edge of the support foil (28) is provided with at least a further layer (30) of the PEDT/PSS and that the foil structure

is embedded partially or completely in the paper pulp line (6).

- 5
13. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the further layer (30) consisting of the PEDT/PSS is used as a bonding agent between the support foils (28) and between the support foils (28) and the metallization (29) of the foil structure serving as the security element as well as as bonding agent between the foil structure and the paper pulp line (6).
- 10
14. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the metallization (29) is applied on one side of the support foil (28) and that the further layer (30) of the PEDT/PSS is applied to the other side.
- 15
15. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact the metallization (29) is applied to one side of the support foil (28) and that the further layer (30) of the PEDT/PSS is applied to the metallization (29).
- 20
16. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the metallization (29) applied to one side of the support foil (28) is covered by a second support foil (28) and that the further layer (30) of the PEDT/PSS is applied to at least one of these support layers (28).
- 25
17. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the further layer (30) of PEDT/PSS has a higher stretch value than the metallization applied to one of the support foils (28; 2).
- 30

18. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact the marking substance is a printing ink containing PEDT/PSS.

5 19. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that prior to its connection with the paper web the PEDT/PSS is connected to at least one foil, a curable lacquer layer, a reflection layer and a protection layer.

10

20.. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the electrically conductive polymer is applied to the support material by a printing, spraying or dipping method.

15

21. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the support material is the paper line itself or a foil to be included in the paper line.

20 22. Electrically conductive marking substance of claim 1 or one of claims 20 and 21, characterized by the fact that the support material is a bonding agent or primer provided on a base material.

23. Electrically conductive marking substance of claim 1 or one of claims 20 to 22, characterized by the fact that the support material is a wrapping or a product.

25

24. Electrically conductive marking substance of claim 1 or one of claims 20 to 22, characterized by the fact that the support material is a security element recognizable by human vision.

30

25. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the PEDT/PSS is applied to the support material as at least one continuous surface.
- 5 26. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the PEDT/PSS is applied to the support material as a surface divided by at least one interruption.
- 10 27. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the PEDT/PSS is applied to the support material as at least one line.
- 15 28. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the PEDT/PSS is applied to the support material in a localized manner.
- 20 29. Electrically conductive marking substance according to one or more of the preceding claims, characterized by the fact that the PEDT/PSS is detectable by multiple testing for its physical and/or chemical properties, preferably for its electric conductivity and optical properties.

Marking Substances and Security Elements and Method of the
5 Integration Thereof in a Paper Pulp Line as well as Method of Testing

COPY TO: 0400

The invention relates to marking substances and security elements, a method of integrating them into the paper pulp line of documents, securities, bank notes, wrappings and products as well as a testing method. The task of
10 the invention is to propose marking substances which contribute to increasing the certainty against counterfeiting and which can be detected only by testing technology operating with extreme accuracy. In accordance with the invention, the marking substance is fed from a supply vessel by way of output tubes into the paper pulp line or, when producing water marks, to the paper
15 pulp line by transfer rollers by way of embossing segments of an embossing roller. The electrically conductive marking substance is connected as an electrically conductive polymer with a foil of the security element to be included in the paper pulp line. Or it is applied as a liquid application medium to the support material. In accordance with the invention, the marking
20 substance is detected by multiple tests in accordance with its electric conductivity, its physical parameters or chemical properties.

Fig. 1

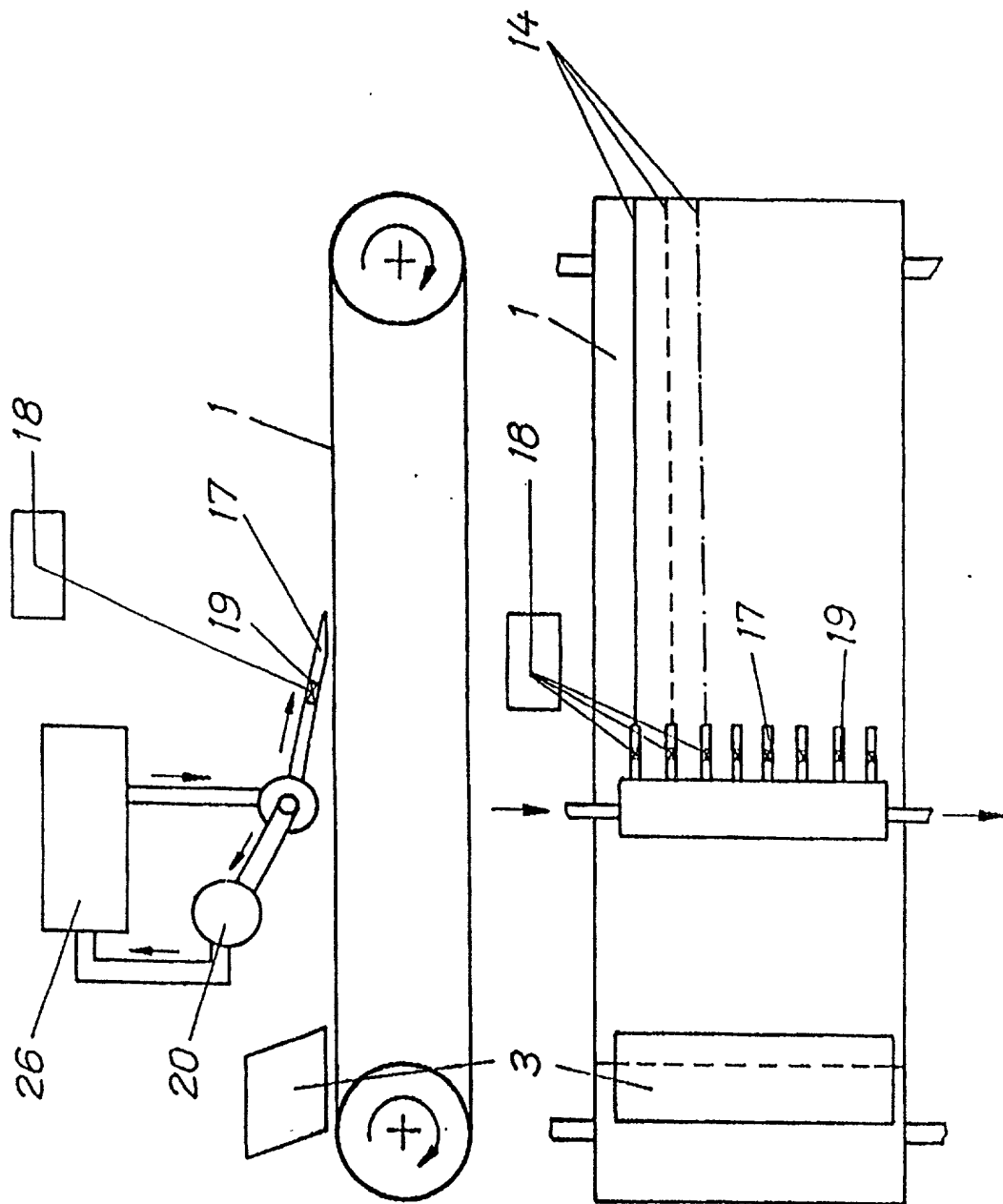


Fig. 2

2 / 11

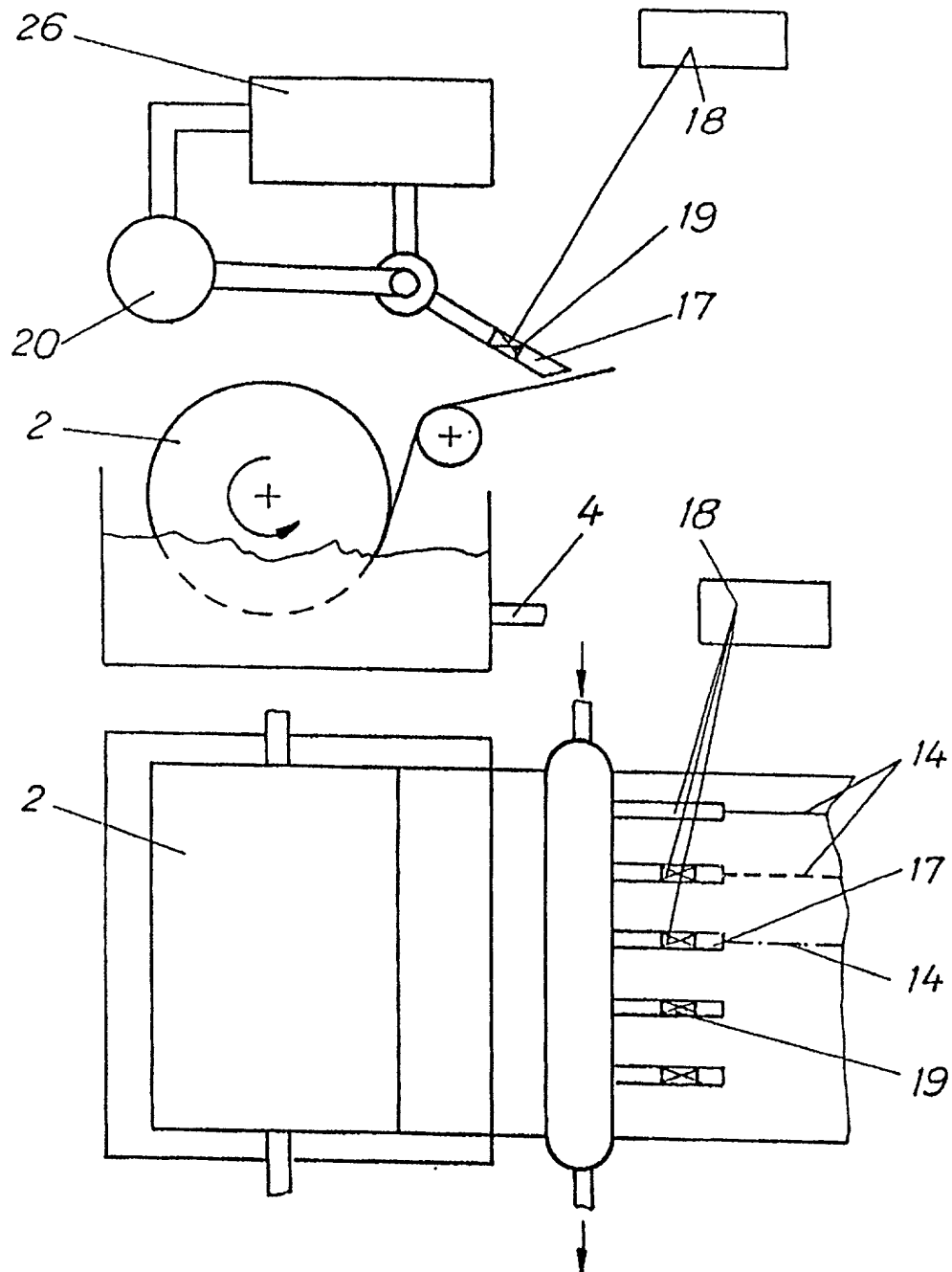


Fig. 3

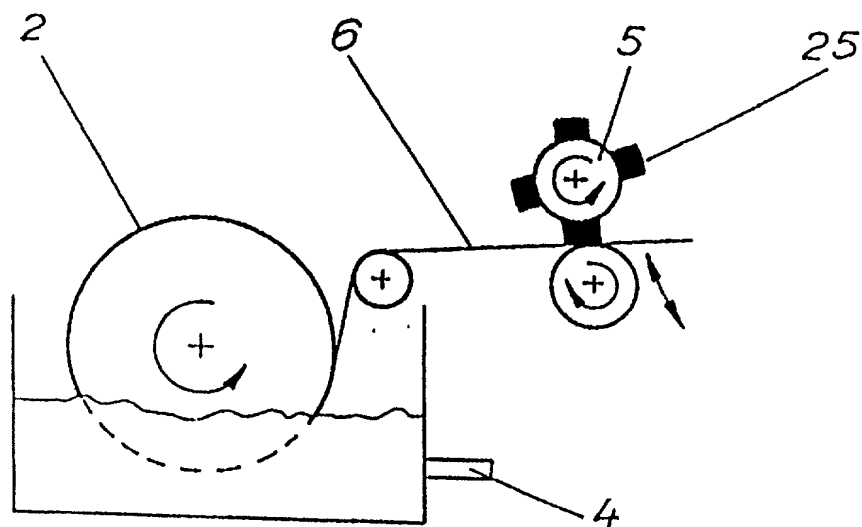


Fig. 8

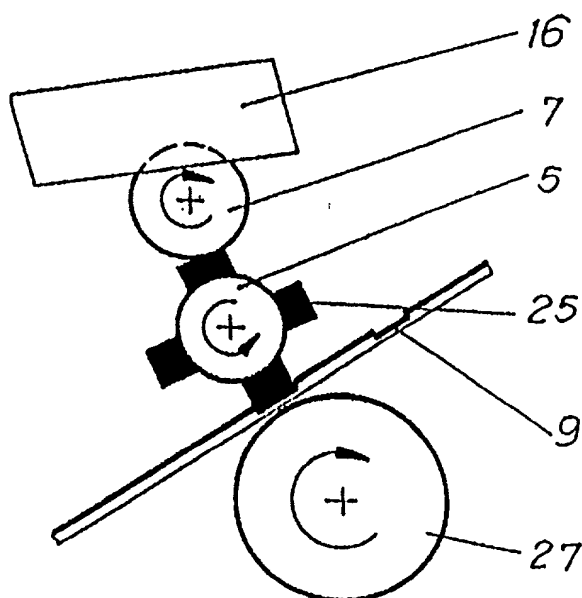


Fig. 3a

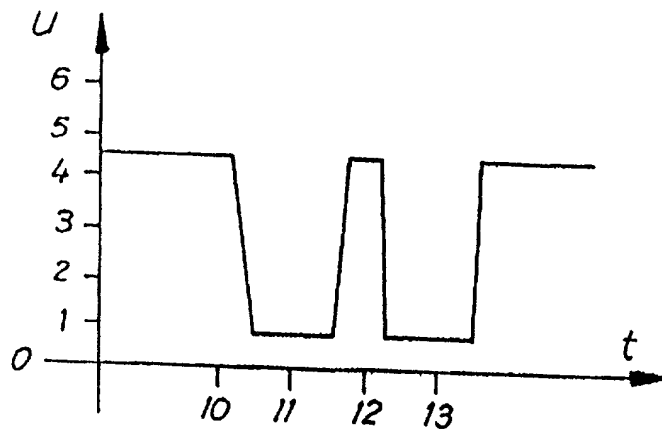
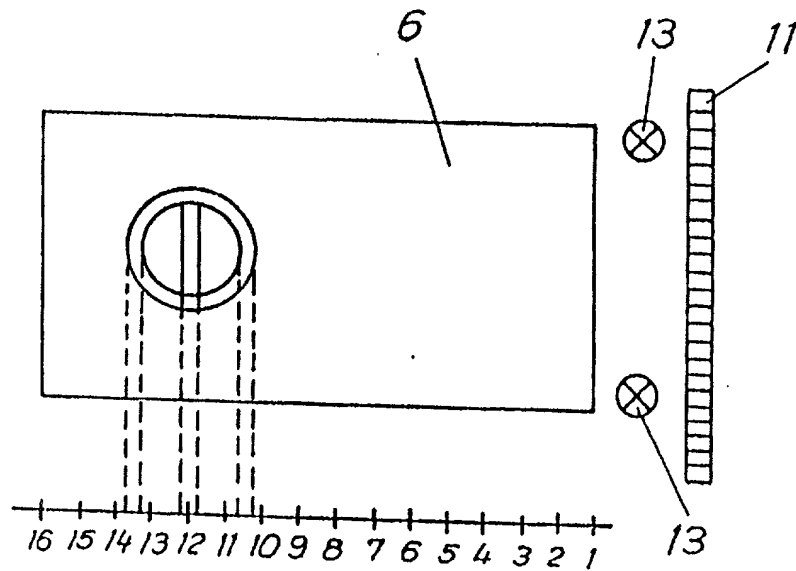


Fig. 4

5 / 11

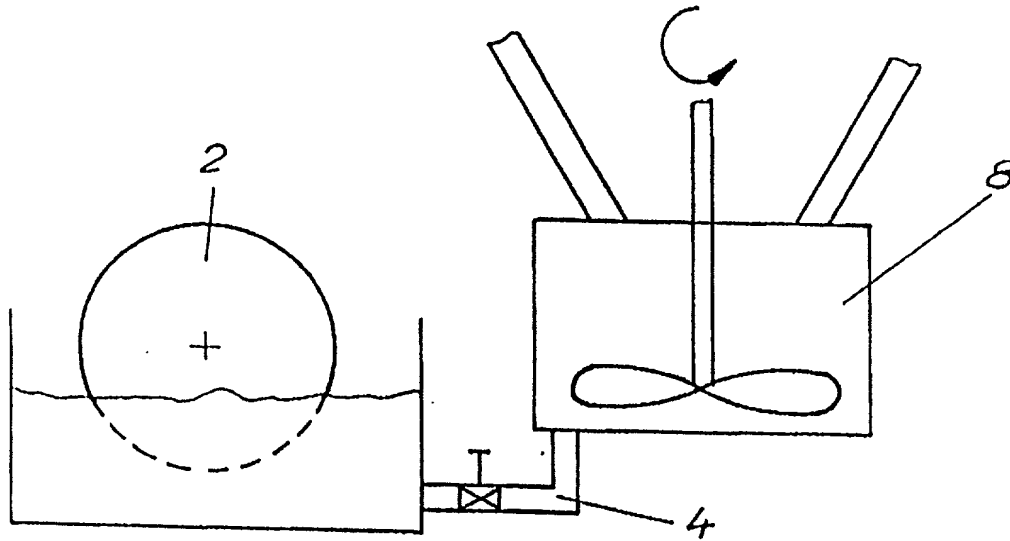


Fig. 5

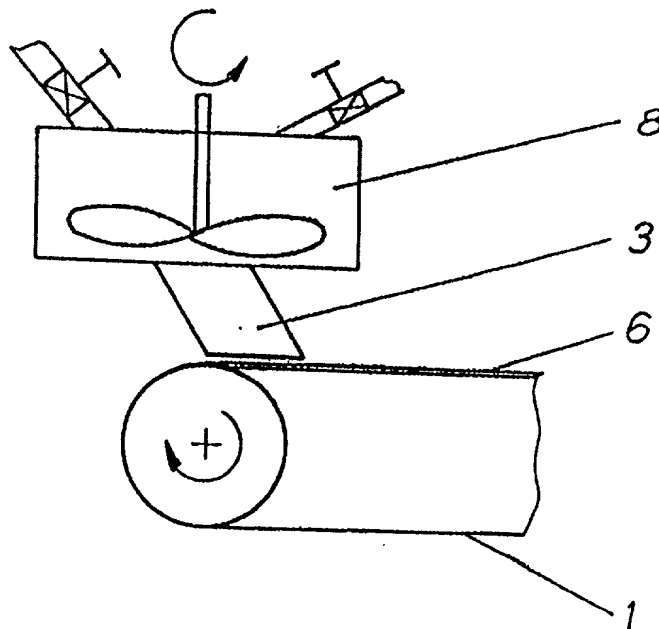


Fig. 6

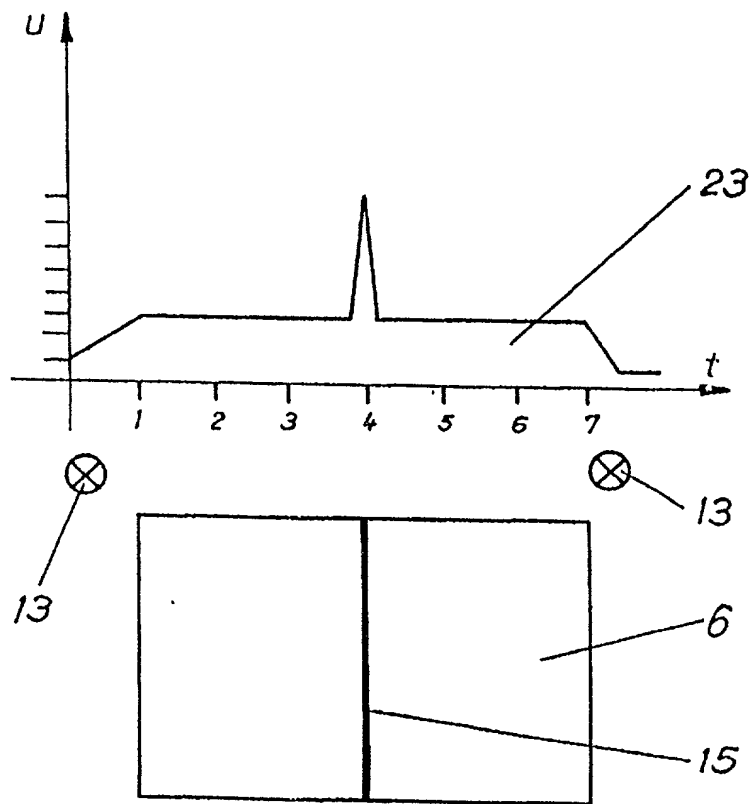
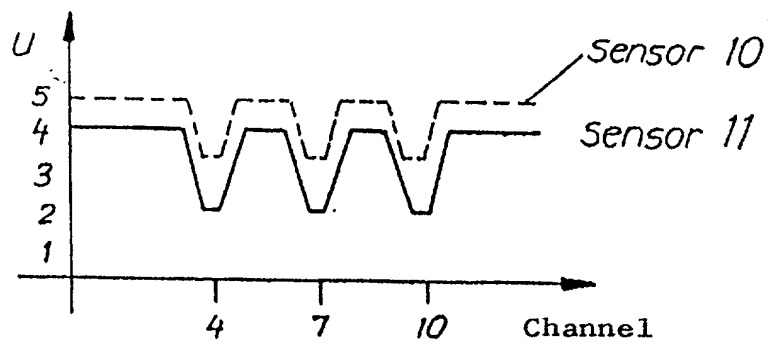
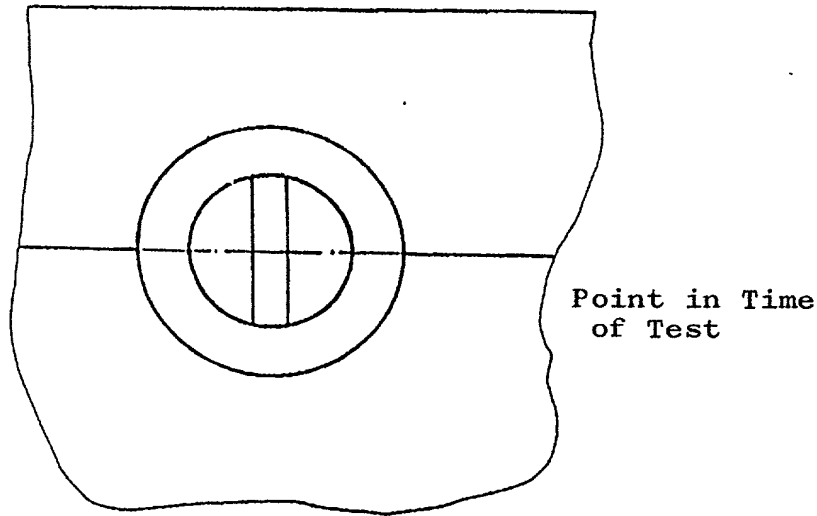
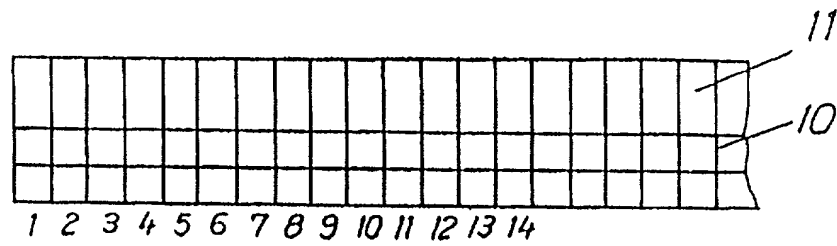


Fig. 7



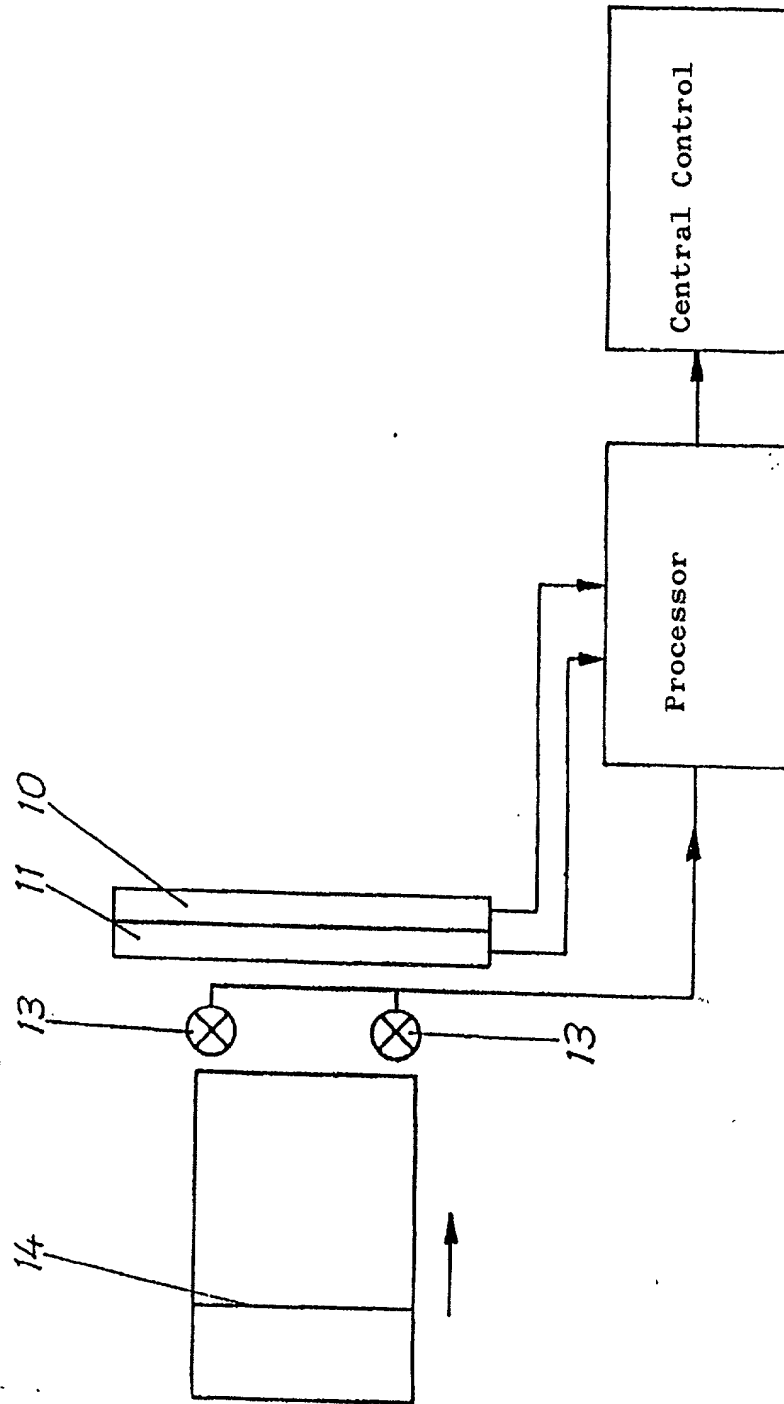
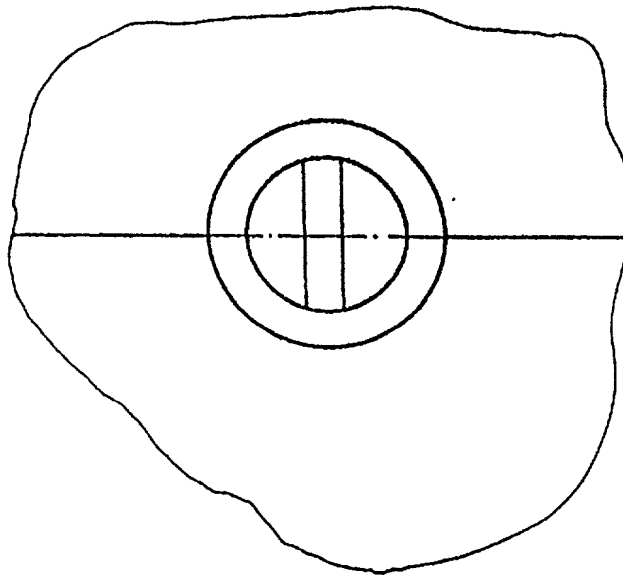
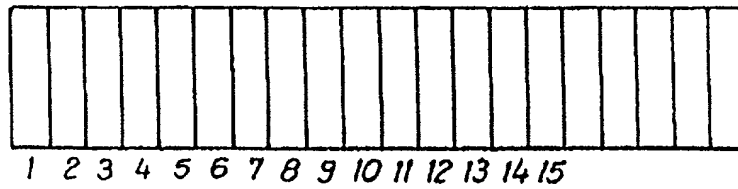


Fig. 7a

Fig. 8a



Time of
Test

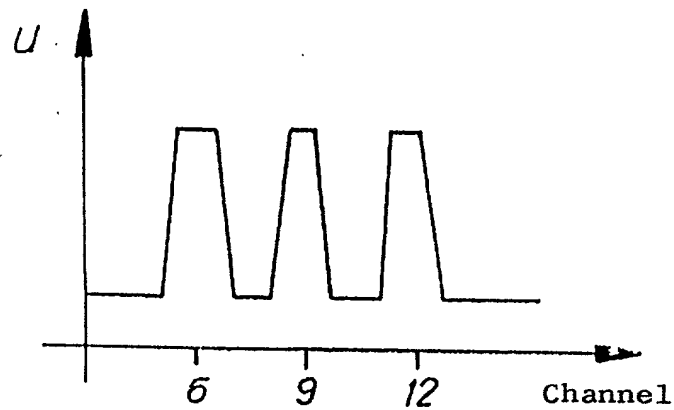


Fig. 9

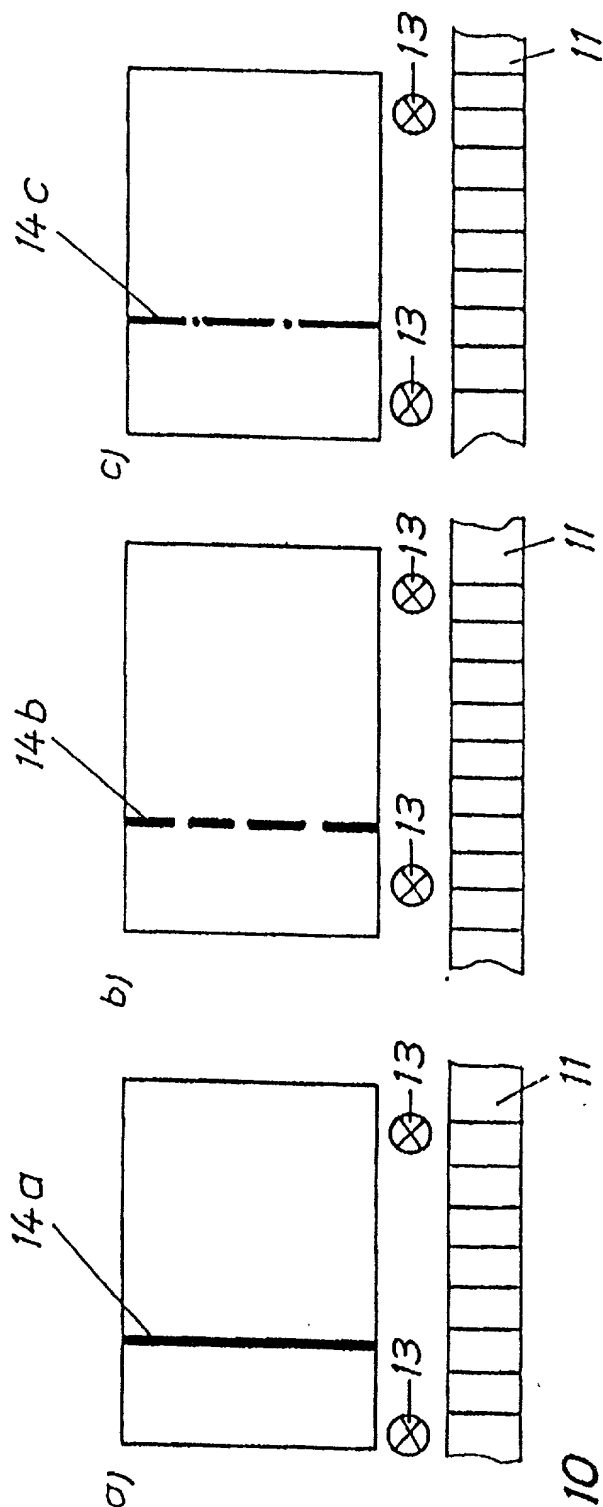
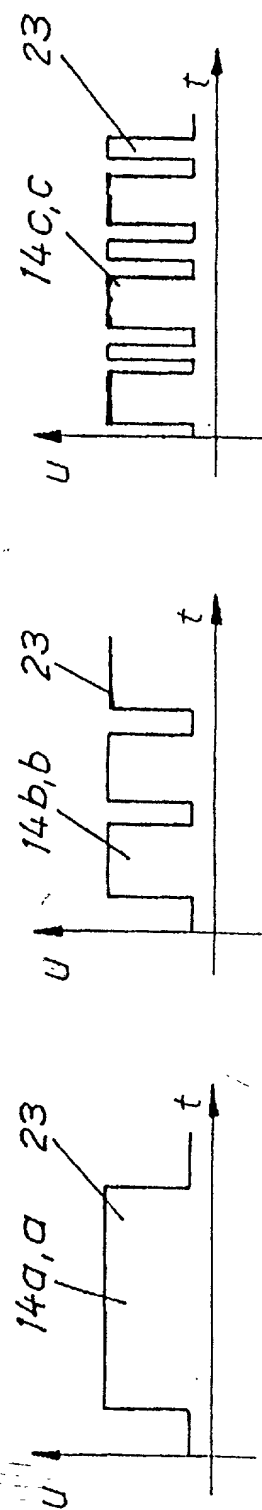
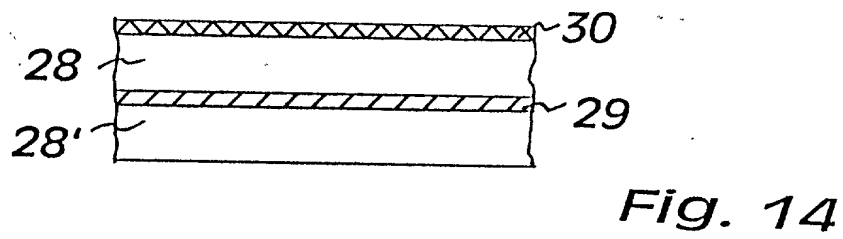
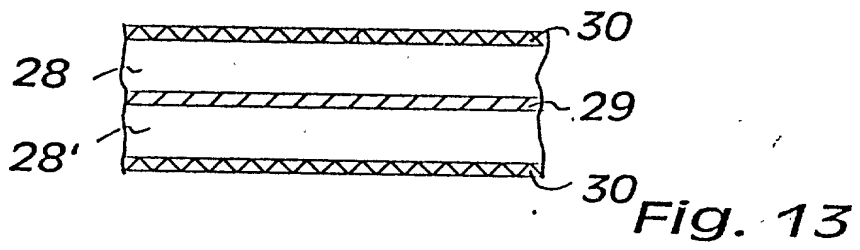
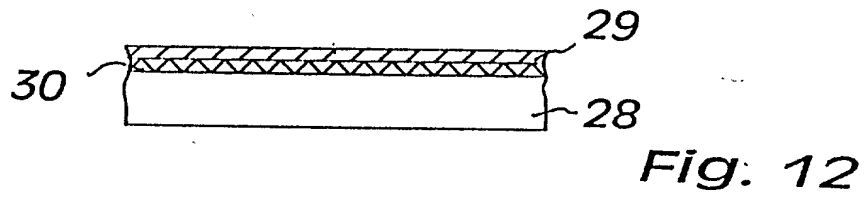
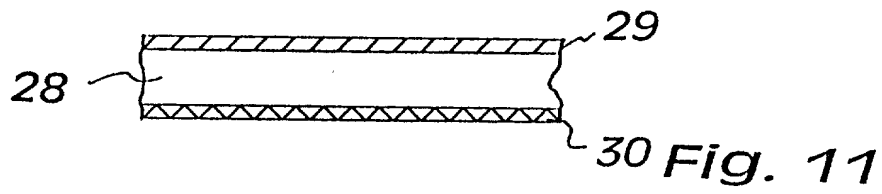


Fig. 10





09/719881-011001

Docket No.
000437

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Marking Substances and Security Markings and Method of Their Integration in Paper Pulp Lines and Method of Testing

the specification of which

(check one)

☐ is attached hereto.

☒ was filed on 18 December 2000 as United States Application No. or PCT International Application Number 09/719,881 and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)	Priority	Not Claimed	
<u>198 26 800.9</u> (Number)	<u>Germany</u> (Country)	<u>16 June 1998</u> (Day/Month/Year Filed)	<input type="checkbox"/>
<u>198 36 503.9</u> (Number)	<u>Germany</u> (Country)	<u>12 August 1998</u> (Day/Month/Year Filed)	<input type="checkbox"/>
<u>199 15 440.6</u> (Number)	<u>Germany</u> (Country)	<u>27 March 1999</u> (Day/Month/Year Filed)	<input type="checkbox"/>
<u>199 28 059.2</u> (Number)	<u>Germany</u> (Country)	<u>15 June 1999</u> (Day/Month/Year Filed)	

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

N/A	
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)
(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

PCT/DE99/01806	15 June 1999	Pending
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)
(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Karl Hormann, Esq., Registration No.: 26,470

Send Correspondence to: Law Offices of Karl Hormann
86 Sparks Street
Cambridge MA 02138-2216

Direct Telephone Calls to: (name and telephone number)
Mr Hormann @ (617)-491-8867

Full name of sole or first inventor PUTTKAMMER, Frank	<u>18.12.2000</u>
Sole or first inventor's signature x <i>[Signature]</i>	Date 18 December 2000
Residence Kastanienstrasse 19, D-01640 Coswig, Germany <i>DEU</i>	
Citizenship German	
Post Office Address same as residence	

Full name of second inventor, if any PUTTKAMMER, Monika <i>Monika Puttkammer</i>	<u>18.12.2000</u>
Second inventor's signature x <i>[Signature]</i>	Date 18 December 2000
Residence Kastanienstrasse 19, D-01640 Coswig, Germany <i>DEU</i>	
Citizenship German	
Post Office Address same as residence	

Full name of third inventor, if any ZSCHERPE, Gunther	18.12.2000
Third inventor's signature <i>Gunther Zscherpe</i>	Date 18 December 2000
Residence Schwarzenberger Strasse 4b, D-08326 Sosa, Germany	
Citizenship German <i>DEX</i>	
Post Office Address same as residence	

Full name of fourth inventor, if any N/A	
Fourth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of fifth inventor, if any	
Fifth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	

Full name of sixth inventor, if any	
Sixth inventor's signature	Date
Residence	
Citizenship	
Post Office Address	